

# Missed and Delayed Preventive Health Care Visits Among US Children Due to the COVID-19 Pandemic

Public Health Reports  
2022, Vol. 137(2) 336–343  
© 2021, Association of Schools and  
Programs of Public Health  
All rights reserved.  
Article reuse guidelines:  
sagepub.com/journals-permissions  
DOI: 10.1177/00333549211061322  
journals.sagepub.com/home/phr



Lydie A. Lebrun-Harris, PhD, MPH<sup>1</sup>; Olivia R. Sappenfield, PhD, MPH<sup>2</sup>; and Michael D. Warren, MD, MPH<sup>1</sup>

## Abstract

**Objective:** The COVID-19 pandemic led to a substantial drop in US children's preventive care, which had not fully rebounded by the end of 2020. We sought to estimate the overall prevalence of missed, skipped, or delayed preventive checkups among households with children in the last 12 months because of the pandemic.

**Methods:** We used data from the US Census Bureau's Household Pulse Survey, Phase 3.1 (collected April–May 2021). The analytic sample included 48 824 households with  $\geq 1$  child or adolescent aged  $< 18$  years. We estimated both national and state-level prevalences, examined associations with sociodemographic and household characteristics, and described reasons for missed or delayed preventive visits.

**Results:** Overall, 26.4% (95% CI, 25.5%–27.2%) of households reported that  $\geq 1$  child or adolescent had missed or delayed a preventive visit because of COVID-19; percentages varied by state, from 17.9% in Wyoming to 37.0% in Vermont. The prevalence of missed or delayed preventive visits was significantly higher among respondents who reported material hardships (ie, not caught up on rent/mortgage, difficulty paying usual household expenses, children not eating enough because of lack of affordability) than among respondents who did not report material hardships. The most common reasons for missing or delaying preventive visits were concern about visiting a health care provider, limited appointment availability, and the provider's location being closed.

**Conclusions:** Programs and policies could reduce gaps in children's preventive care caused by the pandemic, with a particular focus on addressing social determinants of health.

## Keywords

children, preventive health care, pediatric care, forgone care, unmet health care, COVID-19

The direct impacts of the COVID-19 pandemic on children in the United States have been relatively small, yet substantial, compared with the impacts on adults. The Centers for Disease Control and Prevention (CDC) estimated that as of May 2021, 23 million children and adolescents aged 0–17 years had had symptomatic COVID-19, with  $> 200\,000$  hospitalizations and approximately 330 deaths.<sup>1</sup> Since the Delta variant has become dominant in the United States, the number of cases of COVID-19 among children has increased, and although disease severity has not worsened, pediatric hospitalizations have increased as a result of higher overall case numbers.<sup>2,3</sup> The indirect impacts of the pandemic on children's health and well-being have been even more widespread, including parental job loss, family financial struggles, childcare and school closures, extended social isolation, and bereavement.<sup>4–7</sup>

Preventive health care for children is critical for addressing the physical, mental, and emotional sequelae of the pandemic's effects and for providing routine vaccinations, tracking developmental milestones, intervening early on

identified health concerns, and providing support to families. The onset of the pandemic brought a sudden and substantial drop in children's preventive care. From March through July 2020, children insured by Medicaid and the Children's Health Insurance Program (CHIP) received 12% fewer routine vaccinations (among beneficiaries aged  $\leq 2$  years), 29% fewer screening services, and 35% fewer outpatient mental health services.<sup>8</sup> Non-influenza and measles-containing vaccine orders for the Vaccines for Children program substantially decreased after the COVID-19

<sup>1</sup> Maternal and Child Health Bureau, Health Resources and Services Administration, US Department of Health and Human Services, Rockville, MD, USA

<sup>2</sup> US Department of Energy, Oak Ridge Institute for Science and Education, Oak Ridge, TN, USA

## Corresponding Author:

Lydie A. Lebrun-Harris, PhD, MPH, Health Resources and Services Administration, Maternal and Child Health Bureau, Office of Epidemiology and Research, 5600 Fishers Ln, Rockville, MD 20857, USA.

Email: LHarris2@hrsa.gov

national emergency was declared, especially among children and adolescents aged  $>2$  years.<sup>9</sup> As of September 2020, 13% of parents reported delaying or forgoing their children's checkups, well-child visits, and other preventive health screenings.<sup>10</sup> Although children's outpatient visits rebounded by the end of 2020, visit volumes had not returned to pre-pandemic levels, resulting in a 27% cumulative decrease in pediatric visits.<sup>11</sup> Among children aged  $\leq 5$  years, missed visits were more common among lower-income, Black, and Latinx households than among higher-income and White households.<sup>12</sup>

In this study, we analyzed data collected during April–May 2021 from a nationally representative survey to estimate the prevalence and associated covariates of missed or delayed preventive visits among households with children and adolescents aged 0–17 years because of the COVID-19 pandemic. We hypothesized that populations who have historically had poorer access to and use of health care would more frequently report missed or delayed preventive care for children than populations with greater access to and use of health care.

## Methods

We used data from the US Census Bureau's Household Pulse Survey (HPS), initially launched in April 2020 to measure US household experiences during the COVID-19 pandemic.<sup>13</sup> The online survey is administered in English and Spanish and is conducted on a rolling basis, with data publicly released every 2 weeks to provide near-real-time information. Households are randomly sampled using the Census Bureau's Master Address File, and potential respondents are invited by text and/or email to participate in an internet survey. We analyzed data collected from April 14 through May 10, 2021 (weeks 28 and 29), from Phase 3.1 of the HPS. A total of 2 081 251 households were invited to participate, and 147 380 respondents completed the survey, including 48 824 respondents living with children and adolescents aged  $<18$  years. Weekly response rates (proportion of invited households that completed the survey during each 2-week data collection period) ranged from 6.6% to 7.5%.

Respondents were asked, "At any time in the last 12 months, did any children in the household miss, delay, or skip any preventive checkups because of the coronavirus pandemic?" We estimated the proportion of households that reported any missed or delayed pediatric preventive visits, both nationally and by state; calculated  $\chi^2$  statistics (Pearson  $\chi^2$  test of independence for categorical variables) to test for significant bivariate (crude) associations between missed or delayed preventive visits and sociodemographic and household characteristics; and described reasons for children's missed or delayed preventive visits. All analyses used a significance level of .05. Estimates were weighted for nonresponse and to match the Census Bureau's estimates of the US population by age, sex, race, Hispanic

ethnicity, and education level. We conducted analyses in SAS version 9.4 (SAS Institute, Inc) using survey procedures and incorporating 80 replicate weights with Fay's adjustment to account for the complex survey design. Because we analyzed secondary, publicly available data, institutional review board review and approval were deemed not necessary in accordance with the US Department of Health and Human Services regulations for the protection of human subjects in research (45 CFR 46).

## Results

Overall, 26.4% (95% CI, 25.5%–27.2%) of US households with children reported that  $\geq 1$  child or adolescent had missed, skipped, or delayed preventive checkups in the last 12 months because of COVID-19 (Table 1). We found wide variation in missed or delayed preventive visits by state of residence, from 17.9% (95% CI, 11.7%–24.2%) in Wyoming to 37.0% (95% CI, 27.6%–46.4%) in Vermont. In addition, the prevalence of missed or delayed preventive visits differed significantly by US Census region, ranging from 24.9% (95% CI, 23.0%–26.8%) in the Northeast to 28.5% (95% CI, 26.8%–30.2%) in the West.

We found significant differences by respondent race and ethnicity, education, and marital status (Table 2). Children's missed or delayed preventive visits were more frequently reported by respondents who identified as non-Hispanic other/multirace (31.6%; 95% CI, 27.9%–35.3%), had  $\geq$  bachelor's degree (29.4%; 95% CI, 28.7%–30.2%), and were married (27.6%; 95% CI, 26.6%–28.6%) and least frequently reported by respondents who identified as non-Hispanic Black (24.3%; 95% CI, 22.1%–26.5%), had  $\leq$  high school degree/general education development (22.4%; 95% CI, 20.3%–24.5%), and were not married (24.3%; 95% CI, 22.6%–26.0%). In addition, households with 3 to 5 children more frequently reported missed or delayed preventive visits (33.4%; 95% CI, 31.5%–35.3%) than households with fewer children (1 child: 20.7% [95% CI, 19.2%–22.2%]; 2 children: 29.8% [95% CI, 28.5%–31.2%]).

The prevalence of missed or delayed preventive visits was similar across household federal poverty levels ( $P = .63$ ). However, missed or delayed preventive visits were significantly higher among respondents who were not caught up on rent/mortgage (30.6%; 95% CI, 27.8%–33.4%) than among respondents who were caught up on rent/mortgage (26.0%; 95% CI, 25.1%–26.9%;  $P < .001$ ); among respondents who had difficulty paying usual household expenses in the last 7 days (31.8%; 95% CI, 29.8%–33.8%) than among respondents with little or no difficulty paying expenses (23.9%; 95% CI, 23.0%–24.8%;  $P < .001$ ); and among respondents who reported children were not eating enough in the last 7 days because of lack of affordability (37.6%; 95% CI, 33.2%–41.9%) than among respondents whose children never lacked in food (25.0%; 95% CI, 24.3%–25.7%;  $P < .001$ ). We found no significant differences in missed or delayed preventive

**Table 1.** Households with any children aged <18 years who missed, skipped, or delayed a preventive checkup in the last 12 months, by region and state<sup>a</sup>

Household location	Missed or delayed preventive visit because of COVID-19 pandemic	
	No.	% (95% CI) <sup>b</sup>
United States	10 742	26.4 (25.5-27.2)
Region <sup>c</sup>		
Northeast	1631	24.9 (23.0-26.8)
South	3226	25.9 (24.5-27.2)
Midwest	2162	26.1 (24.5-27.7)
West	3723	28.5 (26.8-30.2)
State		
Alabama	124	26.1 (20.3-32.0)
Alaska	271	30.8 (25.9-35.7)
Arizona	273	28.9 (24.7-33.2)
Arkansas	114	25.6 (18.5-32.6)
California	1011	29.9 (26.9-32.9)
Connecticut	258	25.9 (22.2-29.7)
Colorado	175	28.2 (23.8-32.6)
Delaware	112	24.3 (19.4-29.2)
District of Columbia	118	25.5 (17.7-33.2)
Florida	276	21.8 (16.7-26.9)
Georgia	225	26.8 (20.8-32.7)
Hawaii	111	25.1 (19.4-30.9)
Idaho	197	27.4 (22.3-32.4)
Illinois	272	23.7 (20.7-26.7)
Indiana	198	24.9 (19.6-30.1)
Iowa	120	21.2 (16.4-26.0)
Kansas	155	27.1 (22.4-31.8)
Kentucky	114	25.7 (21.0-30.3)
Louisiana	116	24.2 (18.4-29.9)
Maine	101	28.6 (22.2-35.0)
Maryland	306	23.8 (20.1-27.6)
Massachusetts	294	24.3 (21.2-27.5)
Michigan	316	27.6 (22.9-32.2)
Minnesota	298	27.5 (24.3-30.7)
Mississippi	64	24.6 (18.6-30.6)
Missouri	157	26.1 (21.8-30.4)
Montana	85	23.6 (17.0-30.2)
Nebraska	133	23.2 (18.8-27.5)
Nevada	164	29.4 (23.2-35.6)
New Hampshire	159	22.5 (17.9-27.0)
New Jersey	242	28.4 (23.0-33.8)
New Mexico	213	24.2 (20.2-28.1)
New York	205	23.4 (19.1-27.8)
North Carolina	187	25.4 (20.3-30.5)
North Dakota	70	21.5 (15.9-27.2)
Ohio	179	29.6 (23.8-35.4)
Oklahoma	132	24.4 (19.4-29.5)
Oregon	305	28.6 (24.9-32.2)
Pennsylvania	294	26.0 (21.9-30.0)
Rhode Island	83	24.3 (18.2-30.4)
South Carolina	101	25.2 (17.3-33.1)
South Dakota	72	22.3 (15.7-29.0)

(continued)

Table 1. (continued)

Household location	Missed or delayed preventive visit because of COVID-19 pandemic	
	No.	% (95% CI) <sup>b</sup>
Tennessee	164	26.2 (21.9-30.4)
Texas	608	28.6 (25.1-32.0)
Utah	301	22.7 (19.6-25.8)
Vermont	107	37.0 (27.6-46.4)
Virginia	354	29.3 (25.4-33.1)
Washington	445	28.3 (25.1-31.4)
West Virginia	111	29.9 (21.6-38.2)
Wisconsin	192	26.4 (22.0-30.9)
Wyoming	60	17.9 (11.7-24.2)

<sup>a</sup>Data source: US Census Household Pulse Survey Phase 3.1, April 14–May 10, 2021.<sup>13</sup>

<sup>b</sup>Observations are unweighted; percentages are weighted.

<sup>c</sup>Significant at  $P = .02$  using Pearson  $\chi^2$  test of independence.

visits by respondent health insurance or respondent/spouse military status.

The most common reasons given for missed or delayed preventive visits because of COVID-19 were limited appointments available at the health care provider's location (42.7%), concern about going to the health care provider's location (41.9%), and the health care provider's location being closed (28.6%). Furthermore, some respondents reported preventive care was missed or delayed because someone in the household was exposed to the coronavirus (8.6%), someone in the household was ill with coronavirus (7.1%), and the child had a loss or change in health insurance (4.4%).

## Discussion

In this study, 1 in 4 US households reported that  $\geq 1$  child missed, skipped, or delayed preventive visits in the past year because of COVID-19. Notably, households experiencing various material hardships—housing difficulties, food insufficiency, and difficulty paying expenses—were more likely to report missed or delayed preventive visits than those who did not experience material hardships. These findings confirm earlier studies that showed many US children and adolescents have missed critical primary and preventive care because of the pandemic.<sup>5,6,8</sup> Targeted efforts are needed to help families catch up on children's preventive visits, particularly among children who have been economically impacted by COVID-19. Even before the pandemic, US children on average received only 59% of recommended well-child visits.<sup>14</sup> Although caregivers understand the value of these visits, transportation difficulties, challenges associated with taking time off work, childcare issues, and other social stressors are barriers to attending well-child visits.<sup>15</sup> The pandemic has exacerbated these barriers and created new ones, highlighting the need to address social determinants of health to increase children's receipt of primary and

preventive visits. We also found that the prevalence of children's missed or delayed preventive visits increased with higher adult education levels and was slightly higher among households with married respondents than among households with unmarried respondents. These findings contrast with patterns of preventive care use and unmet health care needs typically seen before the pandemic.<sup>16-19</sup> Although the absolute difference between estimates may be small in some cases (with the large sample size likely contributing to significance), it is noteworthy from a clinical and population health standpoint that up to one-third of children in certain subpopulations of interest missed or delayed important preventive care during the pandemic.

Study findings can inform programs and policies to address gaps in children's preventive visits caused by the COVID-19 pandemic. To the extent that missed or delayed preventive visits were caused by hardships, opportunities may exist for promotion of and referrals to primary care when families access other services aimed at addressing those hardships, such as the Special Supplemental Nutrition Program for Women, Infants and Children (WIC).<sup>20</sup> Colocation or coordination of services (eg, WIC and primary care) may further facilitate access to well-child visits and immunizations.<sup>21</sup> The survey findings also draw attention to the linkage between social determinants of health (eg, economic stability, food security) and health-related outcomes. Although policy approaches to address these social determinants (such as provisions in the American Rescue Plan to increase WIC participation) on the surface do not appear to be "health care" solutions, they may in fact alleviate hardships and increase the likelihood of receiving preventive care.<sup>22</sup>

Patterns of care may also have changed during the pandemic. The survey asked about experiences during the past 12 months; however, reports of missed or delayed preventive visits do not necessarily mean that children were still deficient in their receipt of care at the time of survey completion.

**Table 2.** Characteristics of households with children aged <18 years and prevalence of households with children who missed, skipped, or delayed a preventive checkup in the last 12 months, overall and by sociodemographic and household characteristics, April 14–May 10, 2021<sup>a</sup>

Characteristic	Households with children		Missed or delayed preventive visit because of COVID-19 pandemic		P value <sup>c</sup>
	No.	% (95% CI) <sup>b</sup>	No.	% (95% CI) <sup>b</sup>	
Overall	48 824	100.0	10 742	26.4 (25.5-27.2)	
Characteristics of adult respondents <sup>d</sup>					
Race and ethnicity					.03
Non-Hispanic Asian/Pacific Islander	3318	6.0 (5.6-6.4)	697	29.3 (24.4-34.2)	
Non-Hispanic Black	4439	14.7 (14.2-15.3)	798	24.3 (22.1-26.5)	
Hispanic	6350	20.6 (19.9-21.3)	1292	26.6 (24.2-28.9)	
Non-Hispanic White	32 648	54.7 (54.0-55.4)	7443	26.1 (25.3-27.0)	
Non-Hispanic other/multirace	2069	4.0 (3.7-4.2)	512	31.6 (27.9-35.3)	
Education					<.001
≤High school degree/GED	7004	40.2 (39.5-40.9)	1032	22.4 (20.3-24.5)	
Some college/associate's degree	14 846	29.2 (28.6-29.8)	3136	27.7 (26.5-28.8)	
≥Bachelor's degree	26 974	30.6 (30.1-31.1)	6574	29.4 (28.7-30.2)	
Marital status					.001
Married	33 844	60.7 (59.8-61.6)	7848	27.6 (26.6-28.6)	
Not married	14 690 <sup>e</sup>	39.3 (38.4-40.2)	2859 <sup>e</sup>	24.3 (22.6-26.0)	
Health insurance					.06
Private	26 576	58.2 (57.2-59.2)	7729	26.9 (26.0-27.7)	
Any public	9254	29.4 (28.4-30.3)	2379	26.6 (24.7-28.4)	
None	2425 <sup>e</sup>	11.3 (10.6-12.1)	558 <sup>e</sup>	23.2 (20.3-26.2)	
Serving in US Armed Forces or National Guard					.11
Yes	965	1.7 (1.5-1.9)	252	30.9 (25.0-36.9)	
No	47 553 <sup>e</sup>	98.3 (98.1-98.5)	10 452 <sup>e</sup>	26.3 (25.4-27.2)	
Household characteristics					
No. of children					<.001
1	22 424	45.6 (44.8-46.5)	3920	20.7 (19.2-22.2)	
2	17 187	33.6 (32.8-34.3)	4254	29.8 (28.5-31.2)	
3-5	9213 <sup>e</sup>	20.8 (20.2-21.5)	2568	33.4 (31.5-35.3)	
% Federal poverty level <sup>f</sup>					.63
≤138%	4846	24.2 (23.4-24.9)	1357	26.0 (23.7-28.3)	
>139%-200%	3872	15.4 (14.6-16.2)	1091	27.8 (25.4-30.2)	
>201%-400%	8590	25.3 (24.5-26.2)	2543	27.5 (25.4-29.7)	
>400%	16 787 <sup>e</sup>	35.1 (34.2-36.0)	4892 <sup>e</sup>	27.0 (26.0-27.9)	
Caught up on rent/mortgage					.001
Yes	33 224	87.9 (86.9-89.0)	9342	26.0 (25.1-26.9)	
No	3190 <sup>e</sup>	12.1 (11.0-13.1)	1101 <sup>e</sup>	30.6 (27.8-33.4)	
Difficulty paying usual household expenses, last 7 days					<.001
Not at all/a little difficult	34 913	67.1 (65.9-68.3)	7765	23.9 (23.0-24.8)	
Very/somewhat difficult	10 985 <sup>e</sup>	32.9 (31.7-34.1)	2970 <sup>e</sup>	31.8 (29.8-33.8)	
Children not eating enough because of lack of affordability, last 7 days					<.001
Never true	38 788	88.3 (87.2-89.3)	9649	25.0 (24.3-25.7)	
Often/sometimes true	3006 <sup>e</sup>	11.7 (10.7-12.8)	1074 <sup>e</sup>	37.6 (33.2-41.9)	
No. of hardships <sup>g</sup>					<.001
0	33 349	62.9 (61.6-64.1)	7322	23.5 (22.7-24.3)	
1	8692	24.4 (23.2-25.6)	2037	28.8 (26.9-30.7)	
2 or 3	3809 <sup>e</sup>	12.7 (11.7-13.8)	1383	35.1 (31.9-38.2)	

Abbreviation: GED, general education development.

<sup>a</sup>Data source: US Census Household Pulse Survey Phase 3.1, April 14–May 10, 2021.<sup>13</sup><sup>b</sup>Observations are unweighted; percentages are weighted.<sup>c</sup>Significant at  $P < .05$  using the Pearson  $\chi^2$  test of independence.<sup>d</sup>Data on sociodemographic characteristics were only collected for the adult respondent, not for the children in the household.<sup>e</sup>Total observations do not add up to overall total because of missing data (respondent did not answer the relevant survey item[s]). Percentages are calculated based on nonmissing data.<sup>f</sup>Calculated using reported 2019 household income.<sup>g</sup>Sum of the 3 hardships (caught up on rent/mortgage, difficulty paying usual household expenses, children not eating enough).

Among reasons for missing or delaying preventive visits, respondents reported being unable to get an appointment, not wanting to go to the clinic, or the clinic being closed. Some of these factors may have been more prevalent closer to the start of the pandemic, when ambulatory care settings were limiting appointments, but practice patterns have changed during the pandemic.<sup>23,24</sup> Regardless of why families did not seek care, some deficits have persisted. CDC noted a 20% decline in measles-containing vaccine orders for 2020-2021 compared with 2019.<sup>25</sup> State immunization programs and clinics can use reminder-recall systems to alert families whose children may be behind on vaccines.<sup>26,27</sup> In a similar manner, practices may need to conduct proactive outreach to encourage families to come in for preventive visits if families are unaware of changes in health care practice patterns and availability of services. Given that 4 in 10 households with missed or delayed preventive visits reported concerns about safety at the provider's location, such outreach may be an important opportunity to inform and reassure parents about steps the provider is taking to keep them and their children safe. Providers may also explore alternate hours (nights/weekends) to improve access, which can address a need that is not unique to the pandemic.<sup>28,29</sup>

Finally, these findings point to important considerations for future emergency planning that incorporate the unique needs of children and adolescents. Delays in well-child visits and immunizations put children at increased risk for infectious disease and missed identification of developmental delays.<sup>30,31</sup> Well-child visits also provide opportunities to identify mental and behavioral health concerns.<sup>32</sup> During the pandemic, the proportion of pediatric emergency department visits for mental/behavioral concerns increased, indicating a need for services that may be addressed during a well-child visit.<sup>33,34</sup> Furthermore, emergency preparedness plans should include alternative care delivery modalities for primary care, such as telehealth, hybrid models, or outdoor or drive-through clinics for administration of routine vaccinations.<sup>35-37</sup> In addition, health insurance plans will need to quickly pivot to support alternative delivery approaches to ensure continuity of care, as did Medicaid and CHIP programs to expand telehealth during the COVID-19 pandemic.<sup>38</sup> The pediatric population is not monolithic and needs may vary across age groups. For example, the design and delivery of telehealth services for adolescents may require special considerations compared with other age groups.<sup>39</sup>

### Limitations

This study had several limitations. First, survey respondents might not be the parents/caregivers of the children living in the household, and some respondents might have been unfamiliar with children's health care use (or lack thereof), potentially leading to inaccurate survey responses. Second, respondents reported their own health insurance type and race and ethnicity, which might not match the health insurance

type and race and ethnicity of children in the household. Therefore, caution is advised in interpreting measures of association between these covariates and missed or delayed preventive visits. Third, the HPS collected sociodemographic information about adult respondents but not about the children in the household; therefore, we were unable to examine differences by child age. Fourth, the HPS is a rapidly implemented experimental data system that relies on online response, increasing susceptibility to nonsampling errors. Specifically, the online survey administration may have posed a barrier to populations with limited access to the internet. However, as of 2021, 96% to 99% of adults aged 18-64 years nationwide reported using the internet.<sup>40</sup> Certain populations, such as low-income households or rural households, have seen sharp increases in smartphone use during the past decade, which enables the completion of web-based tasks, although a digital divide persists.<sup>40,41</sup> Finally, nonresponse bias analyses conducted by the US Census Bureau showed evidence that response patterns differed across demographic domains, which may have led to biased estimates; however, weighting adjustments should mitigate nonresponse bias.<sup>42</sup>

### Conclusion

One-quarter of households with children reported missing, skipping, or delaying preventive checkups because of the COVID-19 pandemic. Additional data are needed to identify those households that continue to lag in pediatric primary and preventive care even as the United States pursues recovery efforts. Material hardships were associated with an increased likelihood of missing or delaying children's preventive visits, and the prevalence of missed or delayed visits increased as the number of hardships increased. Forgone preventive visits can result in missed opportunities to identify developmental delays, protect children against vaccine-preventable diseases, and connect families with health and social resources in the community. Efforts to reduce or eliminate hardships by addressing social determinants of health are needed, as are alternative approaches to care delivery, to ensure the timely receipt of routine pediatric preventive care.

### Disclaimer

The views expressed in this article are those of the authors and do not necessarily reflect the official policies of the US Department of Health and Human Services (HHS) or the Health Resources and Services Administration (HRSA), nor does mention of HHS or HRSA imply endorsement by the US government.

### Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This

project was supported in part by Dr. Sappenfield's appointment to the Research Participation Program at the Health Resources and Services Administration's Maternal and Child Health Bureau, administered by Oak Ridge Associated Universities through the US Department of Energy Oak Ridge Institute for Science and Education.

## References

- Centers for Disease Control and Prevention. Estimated COVID-19 burden. Updated July 27, 2021. Accessed September 8, 2021. <https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/burden.html>
- Siegel DA, Reses HE, Cool AJ, et al. Trends in COVID-19 cases, emergency department visits, and hospital admissions among children and adolescents aged 0-17 years—United States, August 2020–August 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70(36):1249-1254. doi:10.15585/mmwr.mm7036e1
- Delajoy MJ, Ujamaa D, Whitaker M, et al. Hospitalizations associated with COVID-19 among children and adolescents—COVID-NET, 14 states, March 1, 2020–August 14, 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70(36):1255-1260. doi:10.15585/mmwr.mm7036e2
- Deolmi M, Pisani F. Psychological and psychiatric impact of COVID-19 pandemic among children and adolescents. *Acta Biomed.* 2020;91(4):e2020149. doi:10.23750/abm.v91i4.10870
- Dunton GF, Do B, Wang SD. Early effects of the COVID-19 pandemic on physical activity and sedentary behavior in children living in the U.S. *BMC Public Health.* 2020;20(1):1351. doi:10.1186/s12889-020-09429-3
- Patrick SW, Henkhaus LE, Zickafoose JS, et al. Well-being of parents and children during the COVID-19 pandemic: a national survey. *Pediatrics.* 2020;146(4):e2020016824. doi:10.1542/peds.2020-016824
- Kidman R, Margolis R, Smith-Greenaway E, Verdery AM. Estimates and projections of COVID-19 and parental death in the US. *JAMA Pediatr.* 2021;175(7):745-746. doi:10.1001/jamapediatrics.2021.0161
- Centers for Medicare & Medicaid Services. Preliminary Medicaid & CHIP data snapshot: services through July 31, 2020. 2020. Accessed October 5, 2021. <https://www.medicaid.gov/state-resource-center/downloads/covid19-data-snapshot.pdf>
- Santoli JM, Lindley MC, DeSilva MB, et al. Effects of the COVID-19 pandemic on routine pediatric vaccine ordering and administration—United States, 2020. *MMWR Morb Mortal Wkly Rep.* 2020;69(19):591-593. doi:10.15585/mmwr.mm6919e2
- Gonzalez D, Karpman M, Kenney GM, Zuckerman S. *Delayed and Forgone Health Care for Children During the COVID-19 Pandemic.* Urban Institute; 2021.
- Mehrotra A, Chernew ME, Linetsky D, Hatch H, Cutler DA, Schneider EC. *The Impact of COVID-19 on Outpatient Visits in 2020: Visits Remained Stable, Despite a Late Surge in Cases.* Commonwealth Fund; 2021.
- University of Oregon, Center for Translational Neuroscience. Health (still) interrupted: pandemic continues to disrupt young children's healthcare visits. October 13, 2020. Accessed October 5, 2021. <https://medium.com/rapid-ec-project/health-still-interrupted-pandemic-continues-to-disrupt-young-childrens-healthcare-visits-e252126b76b8>
- US Census Bureau. Phase 3.1 Household Pulse Survey technical documentation. Accessed October 7, 2021. <https://www.census.gov/programs-surveys/household-pulse-survey/technical-documentation.html#phase3.1>
- Abdus S, Selden TM. Adherence with recommended well-child visits has grown, but large gaps persist among various socioeconomic groups. *Health Aff (Millwood).* 2013;32(3):508-515. doi:10.1377/hlthaff.2012.0691
- Wolf ER, O'Neil J, Pecsok J, et al. Caregiver and clinician perspectives on missed well-child visits. *Ann Fam Med.* 2020;18(1):30-34. doi:10.1370/afm.2466
- Data Resource Center for Child and Adolescent Health. NSCH interactive data query (2016–present): 2019 National Survey of Children's Health preventive care visit/check-up (stratified by household education). Accessed September 8, 2021. <https://www.childhealthdata.org/browse/survey/results?q=8210&r=1&g=842>
- Data Resource Center for Child and Adolescent Health. NSCH interactive data query (2016–present): 2019 National Survey of Children's Health preventive care visit/check-up (stratified by family structure). Accessed October 14, 2021. <https://www.childhealthdata.org/browse/survey/results?q=8210&r=1&g=837>
- Data Resource Center for Child and Adolescent Health. NSCH interactive data query (2016–present): 2019 National Survey of Children's Health forgone medical care (stratified by household education). Accessed September 8, 2021. <https://www.childhealthdata.org/browse/survey/results?q=8279&r=1&g=842>
- Data Resource Center for Child and Adolescent Health. NSCH interactive data query (2016–present): 2019 National Survey of Children's Health forgone medical care (stratified by family structure). Accessed October 14, 2021. <https://www.childhealthdata.org/browse/survey/results?q=8279&r=1&g=837>
- Shefer AM, Fritchley J, Stevenson J, et al. Linking WIC and immunization services to improve preventive health care among low-income children in WIC. *J Public Health Manag Pract.* 2002;8(2):56-65. doi:10.1097/00124784-200203000-00008
- Kendal AP, Peterson A, Manning C, Xu F, Neville LJ, Hogue C. Improving the health of infants on Medicaid by collocating special supplemental nutrition clinics with managed care provider sites. *Am J Public Health.* 2002;92(3):399-403. doi:10.2105/ajph.92.3.399
- US Department of Agriculture, Food and Nutrition Service. WIC and WIC FMNP informational memorandum: American Rescue Plan Act of 2021 (PL 117-2), program modernization. March 15, 2021. Accessed May 31, 2021. <https://www.fns.usda.gov/wic/american-rescue-plan-act-program-modernization>
- Macy ML, Huetteman P, Kan K. Changes in primary care visits in the 24 weeks after COVID-19 stay-at-home orders relative to the comparable time period in 2019 in metropolitan Chicago and northern Illinois. *J Prim Care Community Health.* 2020;11:2150132720969557. doi:10.1177/2150132720969557
- O'Leary ST, Cataldi J, Lindley MC, et al. US primary care providers' experiences and practices related to routine pediatric vaccination during the COVID-19 pandemic. 2021. Accessed October 7, 2021. <https://www.cdc.gov/vaccines/hcp/pediatric-practices-during-COVID-19.html>
- Centers for Disease Control and Prevention. Childhood vaccination toolkit for clinicians. 2021. Accessed October 7, 2021.

- <https://www.cdc.gov/vaccines/hcp/childhood-vaccination-toolkit.html>
26. Kempe A, Stockwell MS, Szilagyi P. The contribution of reminder-recall to vaccine delivery efforts: a narrative review. *Acad Pediatr*. 2021;21(4s):S17-S23. doi:10.1016/j.acap.2021.02.016
  27. Vogt TM, Zhang F, Banks M, et al. Provision of pediatric immunization services during the COVID-19 pandemic: an assessment of capacity among pediatric immunization providers participating in the Vaccines for Children program—United States, May 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(27):859-863. doi:10.15585/mmwr.mm6927a2
  28. Hummel K, Mohler MJ, Clemens CJ, Duncan B. Why parents use the emergency department during evening hours for nonemergent pediatric care. *Clin Pediatr (Philadelphia)*. 2014;53(11):1055-1061. doi:10.1177/0009922814540988
  29. Zickafoose JS, DeCamp LR, Prosser LA. Parents' preferences for enhanced access in the pediatric medical home: a discrete choice experiment. *JAMA Pediatr*. 2015;169(4):358-364. doi:10.1001/jamapediatrics.2014.3534
  30. Feldman AG, O'Leary ST, Isakov LD. The risk of resurgence in vaccine preventable infections due to COVID-related gaps in immunization. *Clin Infect Dis*. 2021;73(10):1920-1923. doi:10.1093/cid/ciab127
  31. Wolf ER, Hochheimer CJ, Sabo RT, et al. Gaps in well-child care attendance among primary care clinics serving low-income families. *Pediatrics*. 2018;142(5):e20174019. doi:10.1542/peds.2017-4019
  32. Hagan JF Jr, Shaw JS, Duncan PM. *Bright Futures: Guidelines for Health Supervision of Infants, Children and Adolescents*. 4th ed. Bright Futures; 2017.
  33. Krass P, Dalton E, Doupnik SK, Esposito J. US pediatric emergency department visits for mental health conditions during the COVID-19 pandemic. *JAMA Netw Open*. 2021;4(4):e218533. doi:10.1001/jamanetworkopen.2021.8533
  34. Adjemian J, Hartnett KP, Kite-Powell A, et al. Update: COVID-19 pandemic—associated changes in emergency department visits—United States, December 2020–January 2021. *MMWR Morb Mortal Wkly Rep*. 2021;70(15):552-556. doi:10.15585/mmwr.mm7015a3
  35. Francis D, Kang K, Marrero S, Shaw L. Hybrid well child visits in the age of COVID: how to balance shelter in place with primary care? *Pediatrics*. 2021;147(3):965-966. doi:10.1542/peds.147.3\_MeetingAbstract.965
  36. Menon DU, Belcher HME. COVID-19 pandemic health disparities and pediatric health care—the promise of telehealth. *JAMA Pediatr*. 2021;175(4):345-346. doi:10.1001/jamapediatrics.2020.5097
  37. Bramer CA, Kimmins LM, Swanson R, et al. Decline in child vaccination coverage during the COVID-19 pandemic—Michigan Care Improvement Registry, May 2016–May 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(20):630-631. doi:10.15585/mmwr.mm6920e1
  38. Centers for Medicare & Medicaid Services. State Medicaid & CHIP telehealth toolkit: policy considerations for states expanding use of telehealth, COVID-19 version. Accessed October 7, 2021. <https://www.medicare.gov/medicaid/benefits/downloads/medicaid-chip-telehealth-toolkit.pdf>
  39. Wong CA, Madanay F, Ozer EM, et al. Digital health technology to enhance adolescent and young adult clinical preventive services: affordances and challenges. *J Adolesc Health*. 2020;67(2s):S24-S33. doi:10.1016/j.adohealth.2019.10.018
  40. Vogels EA. Digital divide persists even as Americans with lower incomes make gains in tech adoption. 2021. Accessed October 7, 2021. <https://www.pewresearch.org/fact-tank/2021/06/22/digital-divide-persists-even-as-americans-with-lower-incomes-make-gains-in-tech-adoption>
  41. Vogels EA. Some digital divides persist between rural, urban and suburban America. 2021. Accessed October 7, 2021. <https://www.pewresearch.org/fact-tank/2021/08/19/some-digital-divides-persist-between-rural-urban-and-suburban-america>
  42. Peterson S, Toribio N, Farber J, Hornick D. Nonresponse bias report for the 2020 Household Pulse Survey, version 1.0. 2021. Accessed October 7, 2021. [https://www2.census.gov/programs-surveys/demo/technical-documentation/hhp/2020\\_HPS\\_NR\\_Bias\\_Report-final.pdf](https://www2.census.gov/programs-surveys/demo/technical-documentation/hhp/2020_HPS_NR_Bias_Report-final.pdf)